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METHOD OF TREATING SOIL WITH AQUEOUS SLURRY OF LATTICE CLAY AND ANIONIC POLYELECTROLYTE

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This invention relates to the prevention of water infiltration into porous soil surfaces. More specifically the invention relates to compositions which are readily dispersible in water to make suspensions useful in preventing the seepage of water from conduits or reservoirs. More particularly the invention relates to lining of irrigation canals and other excavations in porous surface strata.

It has long been known that bentonite and other expanding lattice clays can be prepared in aqueous mixtures or suspensions, which can be used for lining irrigation canals and for rendering impervious the walls and bottoms of stock ponds and other water reservoirs. The usual procedure involved in these practices requires the preparation of the suspension, applying it to the porous surface and permitting the suspending water to drain leaving on the surface a coating or layer of bentonite. The surface so prepared is relatively resistant to the percolation of water, but the bentonite will eventually be eroded and redispersed in the water, thereby making necessary periodic renewals of the lining or surface coating.

Other difficulties may be encountered in periods of low water level in the canal or water storage area. The portions of the protective coating exposed to a dry atmosphere, or particularly to the drying effect of direct sunlight, may become hard and brittle, and due to the inherent contractual properties of the bentonite, the surface may check forming wide cracks and many severed segments of the surface coating. Upon reflooding the area or otherwise moistening the surface coating, the original impervious surface is not restored, and the canal or reservoir will not be effective in retaining water unless relined or patched with more of the aqueous bentonite.

One purpose of the invention is to provide a bentonite surface coating which is resistant to checking upon drying, more permanent with respect to its water-impervious properties, and more resistant to redispersion in water. A further purpose is to provide a composition which is readily dispersed in water and which is completely homogeneous and resistant to settling. A further purpose of the invention is to provide thin aqueous slurries of bentonite which have the ability to penetrate porous layers and deposit the suspended bentonite in the interstitial spaces. A still further purpose is to provide a means of permanently lining irrigation ditches and sealing the soil beneath water storage ponds or other reservoirs. The invention has for its fundamental purpose the saving of water in areas of water insufficiency, and the more efficient use of water in irrigated areas.

In accordance with this invention it has been found that bentonite or other expanding lattice clays such as montmorillonite, hectorite, saponite, nontronite, and other clay type materials in which the particles are flat plate-

like crystals dispersible in water with anionic polyelectrolytes to form stable suspensions. The clays known as expanding lattice clays, are those in which the *c*-axis spacing when saturated with water reaches a maximum greater than 25 angstrom units. For the purpose of this invention the combinations including the anionic polyelectrolytes are much more efficient and more useful than the bentonites alone.

For practicing this invention it is necessary to mix the expanding lattice clay and the anionic polyelectrolyte in specific ratios, for example from 0.01 to 0.1% of polyelectrolyte based on the weight of the bentonite. Optimum performance can be obtained by the use of from 0.025 to 0.05% of polymer.

Useful anionic polyelectrolytes are the water-soluble polymers of olefinic structure, that is with a structure prepared by the polymerization of at least one compound with a single aliphatic unsaturated group, which compounds are polymerized to a weight average molecular weight of at least 10,000. To be water-soluble these polymers must necessarily have substituents such as carboxy acids, carboxy acid salts and carboxy acid anhydrides, and must in contact with water ionize to form polymeric ions with a substantial plurality of negatively charged sites. One type of compound useful in the practice of this invention is the polymer of a carboxylic acid, such as acrylic acid, methacrylic acid, crotonic acid and the sodium, potassium, calcium and ammonium salts of said polymeric acids. Copolymers of these acids, or salts thereof, and other olefinic compounds such as ethylene, propylene, isobutylene, styrene, α-methyl styrene, vinyl acetate, vinyl formate, vinyl alkyl ethers, alkyl acrylates and alkyl halides may also be used in the practice of this invention. Copolymers of more than two olefinic substances will be useful provided that at least one of the compounds contains carboxy anhydride or carboxy salt nuclei or other nuclei which are capable of being converted chemically into one of the said carboxy structures.

Another very useful type of polymer is the copolymers of dicarboxylic acid anhydride or derivatives thereof. These polymers are usually comprised of equal molar proportions of the dicarboxylic acid, for example maleic, fumaric, itaconic, citroconic and aconitic acids, the alkali metal, alkaline earth metal and the salts of these acids, and the partially esterified dicarboxylic acids of the type mentioned, and other olefinic monomers copolymerizable therewith, for example, ethylene, propylene, isobutylene, styrene, α-methyl styrene, vinyl acetate, vinyl chloride, vinyl formate, vinyl alkyl ethers, alkyl acrylates and alkyl methacrylates. If desired one of the comonomeric compounds may be an amide or a quaternary ammonium salt, either substituent of which has a cationic influence, but copolymers involving such cationic substituents must necessarily have present carboxy, carboxy salt or carboxylic anhydride nuclei to overcome the cationic effects and render the whole polymer anionic. Alternatively the maleic acid may be esterified provided that ionizable carboxy groups are present in the comonomer or on the maleic acid grouping, such as in the copolymer of vinyl acetate and the partial methyl ester of maleic acid. If maleic anhydride is copolymerized, it will be hydrolyzed to the acid when the aqueous bentonite slurries are prepared.

One important type of these copolymers is the poly-